REMARKS

The Office Action dated May 22, 2009, has been received and carefully noted. The above amendments to the claims, and the following remarks, are submitted as a full and complete response thereto.

By this Response, claim 2 has been amended to more particularly point out and distinctly claim the subject matter of the present invention. No new matter has been added. Support for the above amendments is provided in the Specification, at least, on page 19, line 25, to page 20, line 11. Accordingly, claims 2, 8, 11, 13-14, and 16-19 are currently pending in the application, of which claims 2 and 11 are independent claims.

In view of the above amendments and the following remarks, Applicants respectfully request reconsideration and timely withdrawal of the pending rejections to the claims for the reasons discussed below.

Claim Rejections under 35 U.S.C. §112, Second Paragraph

The Office Action rejected claims 2, 8, and 16-19 under 35 U.S.C. §112, 2nd paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. The Office Action alleged that it is not clear what is meant by "and comprising a thickness of at least 0.5 mm," in line 5 of claim 2. Specifically, the Office Action alleged that it is not clear whether "a thickness" is referring to the thickness of the alloy, the thickness of the coating, or the thickness of a layer within the alloy.

Accordingly, Applicants have amended claim 2 to more particularly point out and distinctly claim the subject matter of the invention, rendering the rejection of claims 2, 8, and 16-19 under 35 U.S.C. §112, 2nd paragraph, moot.

Therefore, Applicants respectfully request withdrawal of the rejections of claims 2, 8, and 16-19 under 35 U.S.C. §112, 2nd paragraph, and respectfully submit that claim 2, and the claims that depend therefrom, are now in condition for allowance.

Claim Rejections under 35 U.S.C. §102(b)

The Office Action rejected claims 2, 8, 11, 13-14, and 16-19 under 35 U.S.C. §102(b) as being allegedly anticipated by, or in the alternative, under 35 U.S.C. §103(a) as being allegedly unpatentable over Kaufman (U.S. Patent No. 4,011,077). Applicants respectfully submit that the claims recite subject matter that is neither described nor suggested in Kaufman.

Claim 2, upon which claims 8 and 16-19 depend, recites a layered Fe-based alloy. The layered Fe-based alloy includes a coating disposed on an outer surface of a surface layer portion of the layered Fe-based alloy. The coating includes a carbide formed by carbonizing a first element that comprises a property to increase a hardness of the layered Fe-based alloy. The coating has a thickness of at least 0.5 mm. The layered Fe-based alloy also includes a second element including an amount that is greater at the surface layer portion than at an inside portion of the layered Fe-based alloy. An amount of the first element is greater at the inside portion than at the surface layer portion of the layered

Fe-based alloy. A hardness of the layered Fe-based alloy is greater at the inside portion than at the surface layer portion of the layered Fe-based alloy.

Claim 11, upon which claims 13-14 depends, recites a method for producing a layered Fe-based alloy having an increased hardness from a surface layer portion to an inside portion thereof. The alloy further includes a coating existing on an outer surface of the surface layer portion. The coating contains a thickness of at least 0.5 mm and a carbide formed by carbonizing a first element that has a property for increasing hardness of an Fe-based alloy. A second element, other than the first element, is contained in the Fe-based alloy. The second element has an amount which is larger in the surface layer portion as compared with the inside portion. An amount of the first element increases from the surface layer portion to the inside portion. The method includes applying, to a surface of the Fe-based alloy, a powder made up of a substance which contains the second element. The method further includes heat-treating the Fe-based alloy with the powder applied thereto, so that the first element is diffused to the surface layer portion, and the first element reacts with carbon existing in the surface layer portion of the Fe-based alloy to form the carbide.

As noted in the Specification, at least, on page 19, line 25, to page 20, line 11, certain embodiments of the invention provide that a diffusion layer having a thickness of at least 0.5 mm (500 μm) improves the hardness and strength of a Fe-based alloy compared to conventional surface treatment techniques that have a diffusion layer thickness of only about several tens of μm to about 200 μm.

As will be discussed below, Kaufman fails to describe or suggest each and every element recited in claims 2, 8, 11, 13-14, and 16-19, and therefore fails to provide the advantages and the features discussed above.

Kauffman is directed to a mechanical mixture of selected powders that are compressed into a pre-compact, whereby the pre-compact is subjected to liquid phase sintering for producing a raw alloy steel product (*See* Kaufman, Abstract). The mixture of selected powders prevents a premature solid state diffusion of carbon between and into the base iron particles. Certain metallic elements, particularly copper, may be used an effective barrier to carbon loss during heating to the sintering temperature and while in the solid state condition (*See* Kaufman, col. 4, lines 24-38).

Applicants respectfully submit that Kauffman fails to describe or suggest each and every element recited in claims 2 and 11. In particular, Kauffman fails to describe or suggest, at least,

> a layered Fe-based alloy, comprising:
>
> a coating disposed on an outer surface of a surface layer portion of the layered Fe-based alloy, the coating comprising a carbide formed by carbonizing a first element that comprises a property to increase a hardness of the layered Fe-based alloy, and the coating further comprising a thickness of at least 0.5 mm; and
>
> a second element comprising an amount that is greater at the surface layer portion than at an inside portion of the layered Fe-based alloy,
>
> wherein an amount of the first element is greater at the inside portion than at the surface layer portion of the layered Fe-based alloy, and
>
> wherein a hardness of the layered Fe-based alloy is greater at the inside

portion than at the surface layer portion of the layered Fe-based alloy,

as recited in claim 2, and similarly recited in claim 11.

The Office Action alleged that Kauffman describes the same or substantially the same method steps of treating the same or substantially the same composition, as recited in claim 2 (*See* Office Action, page 4). Applicants respectfully disagree.

Kaufman describes the preparation of a hypereutectic iron-carbon-alloy powder. An iron-based powder is mixed with a pre-alloyed powder to form an admixture. The admixture is compacted to a shape having a predetermined density, and then sintered in a sintering furnace under a controlled temperature to about the eutectic temperature for the pre-alloyed powder to allow diffusion of both the alloying ingredients and the carbon into the base iron powder after the liquidus temperature is achieved. The sintered compact may be subjected to post-sintering treatments, preferably in the form of air hardening conditions, allowing the compact to achieve a specific hardness.

As described in column 4, lines 39-45, Kaufman describes that *copper* is applied to the *unalloyed* condition surrounding each particle of the powder. Therefore, Kaufman fails to describe or suggest, at least, "a coating disposed on an outer surface of a surface layer portion of the <u>layered Fe-based alloy</u>, the coating comprising a carbide formed by carbonizing a first element that comprises a property to increase a hardness of the layered Fe-based alloy," as recited in claim 2 (emphasis added), and similarly recited in claim 11.

Furthermore, Kaufman fails to describe or suggest, at least, "heat-treating said Fe-

based alloy with said powder applied thereto, so that said <u>first element is diffused</u> to said surface layer portion, and said <u>first element reacts with carbon existing in said surface layer portion of said Fe-based alloy to form said carbide</u>," as recited in claim 11 (emphasis added). Claim 11 recites a first element being carbonized to form the carbide layer in the coating. The first element is further diffused to a surface layer portion of the Fe-based alloy to form the carbide. Whereas, Kaufman describes that carbon diffuses *into* the base iron particles. Copper is used to regulate the diffusion of carbon into the base iron particles. Because Kaufman describes that the carbon *diffuses* into the base iron particles, it would not be proper to further conclude that the carbon "reacts <u>with carbon</u> existing in said surface layer portion of said Fe-based alloy to form said carbide," as recited in claim 11 (emphasis added) , and similarly recited in claim 2. Accordingly, Kauffman fails to describe or suggest each and every element recited in claims 2 and 11.

Claims 8 and 16-19 depend from claim 2. Claims 13-14 depend from claim 11. Accordingly, claims 8, 13-14 and 16-19 should be allowable for at least their dependency upon an allowable base claim, and for the specific limitations recited therein.

Therefore, Applicants respectfully request withdrawal of the rejections of claims 2, 8, 11, 13-14, and 16-19 under 35 U.S.C. §102(b), or in the alternative, under 35 U.S.C. §103(a), and respectfully submit that claims 2 and 11, and the claims that depend therefrom, are now in condition for allowance.

Claim Rejections under 35 U.S.C. §103(a)

The Office Action rejected claims 2, 8, and 16-19 under 35 U.S.C. §103(a) as being allegedly unpatentable over Tahara (U.S. Patent No. 5,792,282) alone, or alternatively, in view of the ASM Handbook: Volume 4: Heat Treating ("ASM"). In particular, the Office Action alleged that the limitation for the coating "comprising a thickness of at least 0.5 mm" in line 5 of claim 2, is not sufficient to distinguish the subject matter of the claims from the prior art because the limitation *merely changes the proportion (thickness) of a prior art product*. In the alternative, the Office Action alleged that Tahara fails to specify the thickness of the carburized layer. The Office Action cited the ASM to allege that modifying time and/or temperature may achieve a carburized layer thickness greater than 1 mm, and therefore it would have been obvious to one of ordinary skill in the relevant art to have modified the time and temperature for the process described in Tahara to achieve any desired carburized layer thickness. Applicants respectfully disagree. Applicants respectfully submit that the claims recite subject matter that is neither described nor suggested in Tahara or the ASM, whether taken individually or in combination.

As will be discussed below, Tahara or the ASM, whether taken individually or in combination, fail to describe or suggest each and every element recited in claims 2, 8, and 16-19, and therefore fails to provide the features discussed above.

Tahara describes a <u>conventional</u> surface treatment technique for carburizing austenitic stainless steel. In particular, Tahara describes a method of carburizing the

austenitic stainless steel by holding the austenitic steel in a fluorine- or fluoride-containing gas atmosphere with heating prior to carburizing and carburizing the austenitic stainless steel at a temperature not more than 680°C. The austenitic stainless steel is stable and has 1 to 6 weight % molybdenum or 13 to 25 weight % chromium. The carburized hard layer has a corrosion resistance superior to a base material of the austenitic stainless steel (*See* Tahara, Abstract). Tahara further describes that it takes a considerable time to obtain a thick carburized hard layer. Tahara explicitly describes examples of carburized hard layers being formed *only* to a depth of 5 to 70 μm (*See* Tahara, col. 8, lines 35-51, and col. 9, lines 1-4). The surface layer thickness is limited to 70 μm because of the time required to obtain this thickness, *i.e.*, it takes at least 70 hours to obtain a surface layer thickness of 70 μm. Tahara describes that such a long treatment is not economical. Thus, one of ordinary skill in the relevant art would have understood that Tahara does not contemplate surface layer thicknesses greater than 70 μm because it would not have been economical.

Embodiments of the invention provide for a coating "comprising a thickness of <u>at least 0.5 mm</u> (500 μm) (emphasis added). Applicants' Specification describes a diffusion layer 20 having a thickness, *i.e.*, the thickness of the diffused carbide, of at least 0.5 mm (<u>500 μm</u>) from the surface of the forging punch 10. The thickness may be from 3 to 7 mm (<u>3000 to 7000 μm</u>), and may be as great as 15 mm (<u>15,000 μm</u>). Hence, each of the coating thicknesses described in Applicants' Specification are magnitudes greater than

the surface layer thickness of the conventional surface treatment technique described in Tahara.

Applicants' Specification explains that the thick diffusion layer described for embodiments of the invention provides non-obvious advantages over the conventional layer thicknesses as described, for example, in Tahara, such as increased hardness through the alloy where the carbide is diffused, increasing the strength of the alloy in these areas. Therefore, it would not have been obvious to one of ordinary skill in the relevant art, in view of the non-obvious advantages imparted to the alloy material by a coating "comprising a thickness of <u>at least 0.5 mm</u> (500 μm), to have modified the description of Tahara to disclose the features recited in claim 2.

In the alternative, one of ordinary skill in the relevant art would not have been motivated to modify Tahara with the subject matter described in the ASM because modifying the temperature under which the austenitic stainless steel described in Tahara would be heated would render Tahara unsatisfactory for its intended purpose. Tahara explicitly describes that austenitic stainless steel is carburized using a low carburizing temperature no greater than 680 °C, because the austenitic stainless steel is kept from being heated under the fluorine- or fluoride-containing gas atmosphere prior to or at the same time as carburizing. The ASM describes that carburizing steel is limited by the rate of diffusion of carbon in austenite. This diffusion rate increases greatly with increasing temperature. For example, the ASM describes that carburizing commonly occurs at 925 °C, providing diffusion layers greater than 1.0 mm. As previously discussed above,

Tahara operates under specific fluorine- or fluoride-based conditions, such that the temperature cannot be increased greater than 680 °C without damaging the austenitic stainless steel. Therefore, one of ordinary skill in the relevant art would not have used the techniques described in the ASM, where carburizing is not performed in a fluorine- or fluoride-containing gas atmosphere, to modify Tahara because such a modification would damage the austenitic stainless steel, rendering Tahara unsatisfactory for its intended purpose.

Furthermore, the Office Action failed to address Applicants' arguments (on page 15 of Applicants' Response dated March 4, 2009), demonstrating that Tahara describes, at least, "a <u>coating disposed on an outer surface</u> of a surface layer portion of the layered Fe-based alloy, the coating comprising a carbide formed by carbonizing a first element that comprises a property to increase a hardness of the layered Fe-based alloy," as recited in claim 2 (emphasis added). Rather, as noted in the Office Action on page 5, Tahara describes the penetration of carbon from a surface layer portion into an inside portion to form a deep uniform layer (*See* Tahara, col. 6, lines 23-29). Thus, Tahara teaches away from the stainless steel including a member having a coating that exists on <u>an outer surface</u> of a surface layer portion of the stainless steel.

The Office Action failed to demonstrate that the description of Tahara even describes a coating that is <u>disposed on outer surface</u> of a surface layer portion of the layered Fe-based alloy, whereby the coating includes a carbide formed by carbonizing a first element that includes a property to increase a hardness of the layered Fe-based alloy,

as recited in claim 2. The ASM fails to cure the deficiencies of Tahara. Accordingly, Tahara alone, or alternatively in view of the ASM, does not appear to disclose or suggest each and every element recited in claim 2.

Claims 8 and 16-19 depend from claim 2. Accordingly, claims 8 and 16-19 should be allowable for at least their dependency upon an allowable base claim, and for the specific limitations recited therein.

Therefore, Applicants respectfully request withdrawal of the rejections of claims 2, 8, and 16-19 under 35 U.S.C. §102(b), or in the alternative, under 35 U.S.C. §103(a), and respectfully submit that claim 2, and the claims that depend therefrom, are now in condition for allowance.

CONCLUSION

In conclusion, Applicants respectfully submit that Kauffman, Tahara, and the ASM, whether taken individually or in combination, fail to disclose or suggest each and every element recited in claims 2, 8, 11, 13-14, and 16-19. The distinctions previously noted are more than sufficient to render the claimed invention unanticipated and non-obvious. It is therefore respectfully requested that all of claims 2, 8, 11, 13-14, and 16-19 be allowed, and the present application be passed to issuance.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by

telephone, Applicants' undersigned representative at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, Applicants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,

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